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Exceptional Case

EXCEPTIONAL CASE

Minimal change disease soon after Pfizer-BioNTech COVID-19 vaccination

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ABSTRACT

We report on the onset of minimal change disease (MCD) presenting with anasarca after a second dose of the messenger RNA (mRNA)-based Pfizer-BioNTech vaccine against coronavirus disease 2019 (COVID-19). A 75-year-old previously healthy male was admitted with rapidly progressive anasarca and proteinuria of 7.7 g/day following the second dose. A kidney biopsy revealed MCD with nephrotic syndrome. He was treated with intravenous methylprednisolone followed by prednisolone, leading to complete remission after 35 days in the hospital. Since definite causality between the vaccine and MCD remains unclear, awareness of this potential adverse effect of mRNA vaccines is important to determine its true incidence and frequency.

Keywords: COVID-19, minimal change disease, mRNA-based Pfizer-BioNTech COVID-19 vaccine, nephrotic syndrome, pharmacovigilance, steroid therapy

BACKGROUND

As mass vaccination campaigns against coronavirus disease 2019 (COVID-19) progress worldwide, new reports of adverse events following messenger RNA (mRNA)-based Pfizer-BioNTech COVID-19 vaccine have emerged. We report a case of minimal change disease (MCD) presenting with rapidly progressive anasarca after the second dose of this vaccine.

CASE REPORT

A 75-year-old previously healthy male was admitted with acute worsening of anasarca 7 days after his second vaccine injection. He reported pain in the injection site and 2 weeks of increasing lower extremity edema and hydrocele testicle after his first dose. There was no history of non-steroidal anti-inflammatory drug use nor allergy to polyethylene glycol. Results of a routine medical review 1 year earlier had been normal, with serum creatinine of 0.96 mg/dL and normal urinalysis. On admission, his blood pressure was 133/86 mmHg and physical examination revealed generalized edema with a weight gain of 22 kg. Laboratory diagnostics revealed serum creatinine of 1.24 mg/dL, serum albumin 1.1 g/dL, total cholesterol 504 mg/dL and proteinuria 7.72 g/day without active urine sediment. Serological workup revealed no signs of an underlying systemic disease or malignancy. Computed tomography images of his chest and abdomen revealed bilateral moderate pleural effusion and mild ascites.

A kidney biopsy was performed 29 days after the first dose. Light microscopy of the kidney biopsy specimen showed unremarkable abnormalities in 30 glomeruli examined. Tubular atrophy and interstitial fibrosis were almost absent. No immune deposits were identified by immunofluorescence (10 glomeruli) or electron microscopy (7 glomeruli). Electron microscopy

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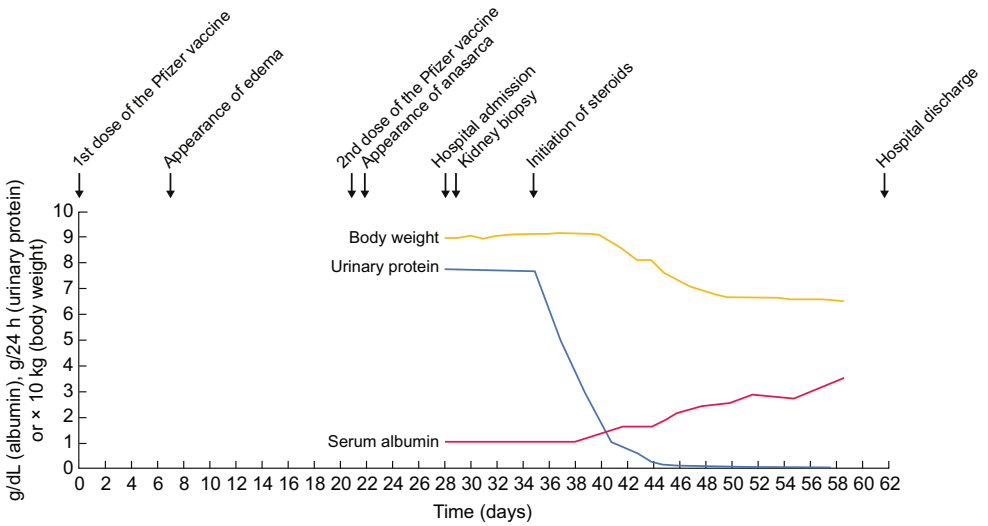

FIGURE 1: A timeline of clinical events and trends in serum albumin (g/dL), urinary protein (g/24 h) and body weight (×10 kg) from time of vaccination until hospital discharge.

revealed diffuse podocyte foot process effacement and glomerular basement membrane (mean range 270 nm), leading to a diagnosis of MCD with nephrotic syndrome.

Intravenous methylprednisolone 1 g for 3 days was initiated 7 days after admission followed by prednisolone 1 mg/kg daily. After 10 days of steroid therapy, urinary protein decreased to 0.2 g/day and edema resolved, with a reduction of 25 kg in body weight. Tapering prednisolone by 10 mg weekly, he achieved complete remission of nephrotic syndrome and was discharged after 35 days in hospital with continued steroid treatment (Figure 1).

DISCUSSION

Several recent case reports have described new-onset MCD after the first dose of the Pfizer-BioNTech vaccine [1, 2]. This is the first report of MCD with nephrotic syndrome developing rapidly progressive anasarca soon after the second dose. Two previous reports of MCD occurred within 1 week of the first dose of the vaccine. The first case was of a 50-year-old healthy man who responded to steroid therapy with complete remission [1]. However, the second case was of a 77-year-old man with diabetes and coronary artery disease who continued to have heavy proteinuria and decreasing glomerular filtration rate despite steroid therapy [2].

The temporal association between intramuscular vaccination and developing MCD in these three cases suggests cell-mediated immune reactions as a possible trigger for podocyte injury. Another possible mechanism may be allergic inflammation by type 2 helper T cells (Th2) through the nucleic acids (NAs) sensor. Immune reaction, especially hypersensitivity reaction, appears to be involved in the development of MCD [3]. Recent studies have shown that the function of self-NAs sensing by T cells can trigger and amplify allergic inflammation independent of known NA sensors in innate immunity [4]. Muscle cells presenting viral mRNA-derived products on major histocompatibility complex class I are eliminated by $CD8^+$ T cells and self-NAs released from dead muscle cells might directly induce T cell co-stimulation. This may be followed by Th2 differentiation and allergic inflammation through Th2, leading to podocytopathy. However, the vaccine is supposed to elicit CD4 cytokine responses involving Th1. Finally, we cannot absolutely exclude a direct toxic effect of the Pfizer-BioNTech vaccine over glomerular capillaries. The precise mechanism by which the Pfizer vaccine induced podocytopathy remains unclear.

Prompt kidney biopsy and initiation of steroid therapy appear to be effective in MCD following mRNA-based COVID vaccine administration. Strict pharmacovigilance will be important to determine the true frequency and potential causality between MCD and these vaccines.

PATIENT CONSENT

The patient gave informed consent to publish his case.

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AUTHORS' CONTRIBUTIONS

S.K. and H.T. took care of the patient. All authors discussed and reviewed the article.

CONFLICT OF INTEREST STATEMENT

None declared.

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